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# The Effect of Fishmeal on the Levels of Zinc,Vitamin A Serum, Nutritional Intake and Shortness Status of Children Aged 2-4 Years after Administration of Vitamin A in Makassar, South Sulawesi, Indonesia

Lydia Fanny*

**Department of Nutrition, Makassar Health Polytechnic, South Sulawesi.*
*Email Address: lydiafanny90@yahoo.com*

**Abstract**

One kind of individual nutrition services offered is supplementation of zinc (Zn) which is recommended to overcome the problem of growth among children. Animal foods which are source of zinc, such as fish, have a high quality of protein, with digestibility as of 96%. High digestibility of protein is necessary for growth and intelligence. This study aim to the effect of fishmeal on the levels of zinc, vitamin A serum, nutritional intake and shortness status of children aged 2-4 years after administration of vitamin A.

This study used experimental study design using Pre-Test and Post-Test Control Group Design. Sample size was 30 individuals, randomly selected among children aged 2-4 years with shortness status after receiving vitamin A supplementation, which was then divided into two groups of treatments: the group of vitamin A, and the group of vitamin A plus fishmeal. Nutritional status was known through anthropometric measurements using the seca and microtoise for weight and height respectively. The tools used were in state of good for use and was already been calibrated. Nutritional intake was obtained using a 24-hour recall with consumer multi-pass method. Enumerator were nutritionists, the supervisor was a professor of nutrition at Health Polytechnic Makassar. The study used an internal ethics committee approval at the department of nutrition.

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* Corresponding author.

Statistical analysis was done using paired t-test with 95% significance. Nutritional intake in group I (Vitamin A), all increased after the intervention except for energy intake. Significance values for energy, protein, fat, carbohydrate, Vitamin A and Zn were (0.278) (0.000) (0.000) (0.010) (0.000) and (0.002) respectively. Nutritional intake in group II (Vitamins A, plus fishmeal), all increased after intervention except energy intake. Significance values for energy, protein, fat, carbohydrate, Vitamin A and Zn were (0.100) (0.000) (0.000) (0.000) (0.000) and (0.001) respectively. Zn levels after intervention in both groups increased significantly. The only obvious difference was in increased levels of albumin which occurred in group II (Vitamin A Plus fishmeal) ($p = 0.010$). There was no increase in total protein levels in group II (Vitamin A plus fishmeal, while in group I, it was found a significant elevated level of total protein ($p = 0.007$). There was an increase in hemoglobin levels in group II but not in group I. Recommendation from the study: it is necessary to perform nutritional services efforts by providing zinc supplementation in children that suffered shortness status after receiving vitamin A.

***Keywords:*** Fishmeal; Level of Zinc; Vitamin A; Nutritional Intake.

**1. Introduction**

The growth process is a continuous process started from during conception up to adulthood, which follows a certain pattern unique to each child. Growth can be defined as increasing physical size which reflects the balance between food intake and nutritional needs of children in the process of growth [1,2,3]. In Indonesia, shortness or stunting is a nutritional problem in infants. The other nutritional problems in children aged 0-24 months in Indonesia were malnutrition (weight for age), severe thinness (weight for height) and severe shortness (height for age) with 5.7%, 6.8% and 19.2% respectively in 2013. Nutritional problems in children aged 0-24 months in South Sulawesi were malnutrition and severe malnutrition (weight for age), severe thinness, and thinness (height by Age) and severe shortness and shortness (height for age) which were 25%, 40% and 11% respectively [4,5].

Triggering factors of those nutritional problems mentioned above were low quality and quantity of nutritional intake. Low macro nutrients intake were of energy and protein intakes, while for micronutrients, they were vitamin A and zinc in particular. Preventive effort to improve nutrition for individuals is through nutritional supplementation, which zinc (Zn) supplementation is one the kind and is recommended to address the growth problems in children. From double-blind study conducted in Vietnam, by administering 10 mg Zn/ day towards 146 children aged 4-36 months for 5 months showed that zinc supplementation increases body weight ($+ 0.5 \pm 0.1$ kg: $p < 0.05$) and body height ($+ 1.5 \pm 0.2$ Kg: $p < 0.001$) (4). Thus, in order to overcome the problem of malnutrition, particularly shortness status is through the administration of Zn supplementation. There are several studies granting sources of zinc from natural ingredients such as fish and resulted increasing levels of Zn which was influenced by protein reserves. Provision of Zn as food can increase the levels of Zn at the time of low zinc status in children with malnutrition [1,6].

Animal source of zinc such as fish and meat can be better absorbed than those of vegetables one. For instances, Euthynnus affinis contains as many as 3 mg Zn per 100gr and the Caesionidae contains as much as 1,5 mg Zn per 100gr, while vegetable sources are often bounded by phytate which can interfere the absorption of Zn [2, 7]. Fish is a source of high quality of protein, with digestibility as much as 96%. High digestibility of protein is necessary for growth and intelligence. Fishmeal is a source of protein that has high value of amino acids. The analysis of nutritional value of fishmeal made of Rastrelliger kanagurta in 100gr it consists of: protein 26.87gr, fat 18.98 g, carbohydrate 36.28g, iodine 2.67 mg, crude fiber 2.51 g and calcium 238 mg, then the fishmeal was tested for its acceptance levels among children under five. The result showed a high level of preference as a topping when eating. For Euthynnus affinis in 100 g, it was obtained 30 mg of Zn, while the Caesionidae contained 15 mg [8].

Based on the frameworks, this study aimed to analyze the provision of Zn-rich fishmeal towards levels of zinc, serum vitamin A and nutritional intake and shortness status of children aged 2-4 years after the administration of vitamin A, in Makassar South Sulawesi, Indonesia.

## 2. Methods and Materials

This study used quasi experimental study. The variable included were the family's identity, the identity of the child, the nutritional status of height by age, intake of macro and micronutrients. Anthropometric measurements were done according to the standard measurement of height and weight the Ministry of Health of the Republic of Indonesia. Macro and micro nutrient intake were obtained using a 24-hour recall with a multi-pass approach. Interviews were performed at respondents' homes independently. Respondents signed study agreements in entirety. Instruments used on the study had been previously tested at 10% of the population and was declared fit for use. Enumerators in this study were nutritionists with diploma degree graduated from Health Polytechnic Makassar. Enumerators were carefully trained to conduct interviews and perform anthropometric measurements. Anthropometric tools used were microtoise for height and were products of Nutritional Department of Health Polytechnic Makassar in 2010 and were in a state of good for use. Data processing and analysis of nutritional status were done using WHO Antro application, 2005.

## 3. Results

### *3.1 Macro and Micro Nutrient Intake*

Energy intake in group I (Vitamin A), did not increase significantly before and after the intervention ($p = 0.278$), the same occurred in group II (Vitamin A plus fishmeal) ($p = 0.237$). Significant increases in the intake of protein, fat, carbohydrates, Vitamin A and Zinc occurred in both groups ($p <0.050$) (Table 1).

### *3.2 Biochemical Indicators*

In this study, measured biochemical indicators were serum levels of Zn, albumin, total protein and hemoglobin.

Zinc serum levels increased significantly in both groups ($p <0.050$). Albumin was not increased in group I (Vitamin A) ($p = 0.360$), but there was an increase in group II (Vitamin A plus fishmeal) ($p = 0.010$). Protein total increased in group I (Vitamin A) ($p = 0.007$), but did not in group II (Vitamin A plus fishmeal) ($p = 0.531$).

Hemoglobin did not increase in group I (Vitamin A) p = 0.092, but increased in group II (Vitamin A plus fishmeal) p = 0.009 (Table 2).

**Table 1:** Macro and Micro Nutrients Intakes of Children

| Intake Variable | Category | Pre- Intervention | | | | Post- Intervention | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Group I (Vit. A) | | Group II (Vit A + fishmeal) | | Group I (Vit. A) | | Group II (Vit A + fishmeal) | |
| | | N | % | n | % | N | % | N | % |
| Energy | • Good | 4 | 26,7 | 5 | 33.3 | 5 | 33,3 | 5 | 33,3 |
| | • Sufficient | 7 | 46.7 | 7 | 46.7 | 8 | 53,3 | 9 | 60,0 |
| | • Insufficient | 4 | 26,6 | 3 | 20.0 | 2 | 13,3 | 1 | 6,7 |
| Protein | • Good | 1 | 6,7 | 14 | 93,3 | 2 | 13,3 | 2 | 13,3 |
| | • Sufficient | 11 | 73,3 | 0 | 0 | 13 | 86,7 | 13 | 86,7 |
| | • Insufficient | 3 | 20,0 | 1 | 6,7 | 0 | 0 | 0 | 0 |
| Fat | • Good | 0 | 0 | 0 | 0 | 2 | 13,3 | 4 | 26,7 |
| | • Sufficient | 12 | 80 | 11 | 73,3 | 13 | 86,7 | 9 | 60,0 |
| | • Insufficient | 3 | 20 | 4 | 26,7 | 0 | 0 | 2 | 13,3 |
| Carbohydrate | • Good | 4 | 26,7 | 4 | 26,7 | 8 | 53,8 | 7 | 46,7 |
| | • Sufficient | 11 | 73,3 | 11 | 73,3 | 7 | 46,7 | 8 | 53,8 |
| | • Insufficient | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Vit. A | • Good | 12 | 80 | 15 | 100 | 13 | 86,7 | 15 | 100 |
| | • Sufficient | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | • Insufficient | 3 | 20 | 0 | 0 | 2 | 13,3 | 0 | 0 |
| Zn | • Good | 13 | 86,7 | 11 | 73,3 | 15 | 100 | 15 | 100 |
| | • Sufficient | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | • Insufficient | 2 | 13,3 | 4 | 26,7 | 0 | 0 | 0 | 0 |

**Table 2:** Macro and Micro Nutrients Intakes

| Group | Intakes | Pre- Intervention, RDA Percentage (x±SD) | Post- Intervention RDA Percentage, (x±SD) | Paired T-Test (p) |
|---|---|---|---|---|
| Vitamin A | 1. Energy | 86,73±11,98 | 88,13±10,99 | 0,278 |
| | 2. Protein | 83,27±8,66 | 88,60±6,56 | 0,000 |
| | 3. Fat | 81,67±6,73 | 87,67±5,94 | 0,000 |
| | 4. Carbohydrate | 94,13±7,16 | 98,07±3,26 | 0,010 |
| | 5. Vitamin A | 403,33±47,91 | 430,73±36,58 | 0,000 |

| | | | | | |
|---|---|---|---|---|---|
| | 6. | Zn | 8,77±0,70 | 8,95±0,71 | 0,002 |
| Vitamin A Plus Fishmeal | 7. | Energy | 90,13±11,62 | 92,00±9,60 | 0,237 |
| | 8. | Protein | 86,33±6,67 | 90,67±5,94 | 0,000 |
| | 9. | Fat | 84,00±8,90 | 89,67±8,34 | 0,000 |
| | 10. | Carbohydrate | 93,93±5,52 | 97,4±3,31 | 0,001 |
| | 11. | Vitamin A | 421,67±23,88 | 446,67±6,99 | 0,003 |
| | 12. | Zn | 8,60±0,68 | 8,91±0,51 | 0,020 |
| Total | 13. | Energy | 88,74±11,72 | 90,00±10,32 | 0,100 |
| | 14. | Protein | 84,0±7,75 | 89,63±6,23 | 0,000 |
| | 15. | Fat | 82,83±7,84 | 88,66±7,18 | 0,000 |
| | 16. | Carbohydrate | 94,03±6,28 | 97,73±3,24 | 0,000 |
| | 17. | Vitamin A | 412,5±38,34 | 438,70±27,11 | 0,000 |
| | 18. | Zn | 8,68±0,68 | 8,92±0,61 | 0,001 |

**Table 3:** Biochemical Indicators Pre and Post Intervention

| | | | | | |
|---|---|---|---|---|---|
| Vitamin A | 1. | Zn | 53,40±8,20 | 63,46±2,29 | 0,000 |
| | 2. | Albumin | 5,53±8,18 | 3,58±0,82 | 0,360 |
| | 3. | Total Protein | 3,28±0,70 | 3,88±0,91 | 0,007 |
| | 4. | Hemoglobin | 10,72±2,08 | 11,80±0,77 | 0,092 |
| Vitamin A Plus Fishmeal | 1. | Zn | 53,73±10,73 | 63,73±10,20 | 0,016 |
| | 2. | Albumin | 3,22±0,63 | 3,90±0,47 | 0,010 |
| | 3. | Total Protein | 3,70±1,37 | 4,02±0,58 | 0,531 |
| | 4. | Hemoglobin | 10,13±1,47 | 11,73±1,38 | 0,009 |
| Total | 1. | Zn | 53,56±9,39 | 63,60±7,36 | 0,000 |
| | 2. | Albumin | 4,38±5,82 | 3,74±0,68 | 0,547 |
| | 3. | Total Protein | 3,53±1,1 | 3,95±0,75 | 0,056 |
| | 4. | Hemoglobin | 10,43±1,77 | 11,76±1,10 | 0,002 |

## 4. Discussion

Energy intake in group I (Vitamin A), was not increased significantly before and after the intervention ($p = 0.278$), the same occurred in group II (Vitamin A plus fishmeal) ($p = 0.237$). Significant increases were found in the intake of protein, fat, carbohydrates, Vitamin A and Zinc and was occurred in both groups ($p <0.050$). Energy intake is important, to support normal metabolic processes for body growth and development. Deficiency of energy intake results to growth failure. The most noticeable feature in growth failure is short stature (stunting). The entire sample in this study was children with shortness. Food consumption history of the children with shortness begins with a low energy intake since age of infancy. To feed children with insufficient nutrients result to shortness in the long term particularly in the period of growth.

Low energy intake results to low effectiveness of utilization of micronutrients. It is important in a child's feeding intervention, to put energy intake as the primary indicator. This means that all nutritional intervention in children should be performed only when the energy intake meets nutritional needs. When energy needs do not meet the needs, then theoretically it is difficult to obtain a positive effect on the indicator of growth and development of children. The main difficulty in this study was to increase energy intake, while the food security in household was also poor. This study was conducted towards low-income groups. Limitation of this study was that it did not include socio-economic variables as controlled variable. Difficulty to perform insulation in every family was the main reason. From the results of this study, it demonstrated that the combination of vitamin A and Zinc provides better results for reducing morbidity from the diseases [9,10, 11]

In this study, measured biochemical indicators were serum levels of Zn, albumin, total protein and hemoglobin. The increase of zinc serum levels was significant in both groups ($p < 0.050$). Albumin was not increased in group I (Vitamin A) ($p = 0.360$), and there was an increase in group II (Vitamin A plus fishmeal) ($p = 0.010$). Protein total increased in group I (Vitamin A) ($p = 0.007$), but did not in group II (Vitamin A plus fishmeal) ($p = 0.531$). Hemoglobin did not increase in group I (Vitamin A) ($p = 0.092$), but did increase in group II (Vitamin A plus fishmeal) ($p = 0.009$) (Table 2). Zinc deficiency since the time of conception will affect the child's height growth. For this reason it is important to perform zinc supplementation. The best way is through enrichment of sources of zinc. The advantage is that if the food sources of zinc are used then the sustainability of the program will be very well [12].

## 5. Conclusion

From final result of this study it can be concluded that the intervention of vitamin A supplementation can be coupled with a zinc-rich foods such as fishmeal.

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**Conflict Of Interest**

This study did not have any conflict of interests with any party involved in the study. The study was planned, performed, monitored and the results reported scientifically and was not be intervened by another party.

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